Abhrajyoti Kundu
Computer Science & IT (CS)

THEORY OF COMPUTATION-2: (GATE 2022) - REPORTS

OVERALL ANALYSIS | COMPARISON REPORT | SOLUTION REPORT

ALL(17) | CORRECT(11) | INCORRECT(5) | SKIPPED(1)

Q. 1 ? FAQ | Solution Video | Have any Doubt ?

The collection of decidable languages is not closed under the operation of

A Union

B Complementation

C Intersection

D None of the above — Your answer is **Correct**

Solution :
(d)
Decidable languages are closed under union, complementation, concatenation, intersection, star operation.

QUESTION ANALYTICS +

Q. 2 ? FAQ | Solution Video | Have any Doubt ?

Which of the following grammars is a (right) regular grammar with the same language as the regular expression a* + b* + ab?

A
$S \rightarrow AB$
$A \rightarrow aA \mid \in$
$B \rightarrow bB \mid \in$

B
$S \rightarrow ab \mid A \mid B$
$A \rightarrow Aa \mid \in$
$B \rightarrow Bb \mid \in$

C
$S \rightarrow A \mid B$
$A \rightarrow aA \mid b$
$B \rightarrow Bb \mid a$

D
$S \rightarrow ab \mid A \mid B$
$A \rightarrow aA \mid \in$
$B \rightarrow bB \mid \in$
— Your answer is **Correct**

Solution :
(d)

QUESTION ANALYTICS +

Q. 3 ? FAQ | Solution Video | Have any Doubt ?

Let L_1 and L_2 be languages over $\Sigma = \{a, b\}$ represented by the regular expresions $(a^* + b)^*$ and $(a + b)^*$ respectively.
Which of the following is true with respect to the two languages?

A $L_1 \subset L_2$

B $L_2 \subset L_1$

C $L_1 = L_2$ — Your answer is **Correct**

Solution :
(c)
Both L_1 and L_2 generate all the strings over 'a' and 'b'. Hence both are same.

D $L_1 \cap L_2 = \phi$

QUESTION ANALYTICS +

Q. 4 FAQ | Solution Video | Have any Doubt ?

Let L_1 be a decidable language and L_2 be a Turing recognizable but not decidable language. Which of the following statements are true?

A $L_2 \backslash L_1$ is a Turing recognizable language — Correct Option

Solution :
(a)

B $L_2 \cap L_1$ is a Turing decidable language

C $L_2' \cap L_1'$ is a Turing recognizable language

D $L_1 \backslash L_2$ is a Turing decidable language

QUESTION ANALYTICS +

Q. 5 Solution Video | Have any Doubt ?

Which of the following statements is true?

A The union of two context free languages is context free. — Your answer is **Correct**

Solution :
(a)
• Context free languages are not closed under complementation and intersection.
Hence option (b) and (c) is false.
• DPDA is less powerful than PDA. Hence there is CFL language which can not be accepted by DPDA.
Hence option (d) is false.

B The intersection of two context free languages is context free

C The complement of a context free language is context free.

D If a language is context free, it can always be accepted by a deterministic pushdown automaton.

QUESTION ANALYTICS +

Q. 6 Solution Video | Have any Doubt ?

Consider the following statements:
S_1 : Language L is Turing-recognizable if a non-deterministic Turing Machine recognizes it.
S_2 : Every CFL is Turing-decidable.
S_3 : $REG_{TM} = \{\langle M \rangle \mid M \text{ is a TM and } L(M) \text{ is regular}\}$ is decidable.
The number of the correct statements is/are _____.

2 — Correct Option

Solution :
2
S_1 : True
S_2 : True
S_3 : False, checking regularity of TM is undecidable.

Your Answer is 3

QUESTION ANALYTICS +

Q. 7 FAQ | Solution Video | Have any Doubt ?

Consider the following languages:
I. $\{a^m b^n c^p d^q \mid m + p = n + q, \text{ where } m, n, p, q \geq 0\}$

II. $\{a^m b^n c^p d^q \mid mn = p + q$, where $m, n, p, q \geq 0\}$
III. $\{a^m b^n c^p d^q \mid m = n$ and $p = q$, where $m, n, p, q \geq 0\}$
IV. $\{a^m b^n c^p d^q \mid m = n = p$ and $p = q$, where $m, n, p, q \geq 0\}$
How many of the above languages are context free?

2 — Your answer is Correct2

Solution :
2
I. $\{a^m b^n c^p d^q \mid m + p = n + q\}$ is CFL because we can rearrange the equation as $m - n + p - q = 0$ which can be done by push, pop, push and pop respectively and check if stack is empty or not.
II. $\{a^m b^n c^p d^q \mid mn = p + q\}$ is not a CFL, since mn involves multiplying number of a's and number of b's which cannot be done by a PDA.
III. $\{a^m b^n c^p d^q \mid m = n$ and $p = q\}$ is CFL since one comparison at a time can be done by PDA.
IV. $\{a^m b^n c^p d^q \mid m = n = p$ and $p = q\}$ is not CFL since $m = n = p$ is a double comparison which can not be done by PDA.

QUESTION ANALYTICS +

Q. 8 — FAQ | Solution Video | Have any Doubt ?

Which of the following is/are correct for Turing recognizable?

A. TM halts in an accepting configuration if w is in the language. — Your option is Correct
B. TM may halt in a rejecting configuration or go on indefinitely if w is not in the language. — Your option is Correct
C. TM halts in a rejecting configuration if w is not in the language. — Your answer is IN-CORRECT
D. TM whether halts or not depends on the given input. — Your option is Correct

YOUR ANSWER - a,b,c,d | CORRECT ANSWER - a,b,d | STATUS -

Solution :
(a, b, d)
Turing-recognizable languages:
- TM halts in an accepting configuration if w is in the language.
- TM may halt in a rejecting configuration or go on indefinitely if w is not in the language.

Turing-decidable languages:
- TM halts in an accepting configuration if w is in the language.
- TM halts in a rejecting configuration if w is not in the language.

QUESTION ANALYTICS +

Q. 9 — FAQ | Solution Video | Have any Doubt ?

Consider L_1 is regular language, L_2 is context free language, L_3 is recursive language and L_4 is recursively enumerable language.

A. $\overline{L_3} \cup L_4$ is recursively enumerable language. — Your option is Correct
B. $L_1 \cdot L_2$ is regular language.
C. $L_1^* \cap L_2$ is context free language. — Your option is Correct
D. $\overline{L_2} \cup L_3$ is context free language.

YOUR ANSWER - a,c | CORRECT ANSWER - a,c | STATUS -

Solution :
(a, c)
(a) $\overline{L_3} \cup L_4 = \overline{\text{REC}} \cup \text{RE} = \text{RE}$
(b) $L_1 \cdot L_2 = \text{Reg} \cdot \text{CFL} = \text{CFL}$
(c) $L_1^* \cap L_2 = (\text{Reg})^* \cap \text{CFL} = \text{Reg} \cap \text{CFL} = \text{CFL}$
(d) $\overline{L_2} \cup L_3 = \overline{\text{CFL}} \cup \text{REC} = \text{CSL} \cup \text{REC} = \text{REC}$
So, only (a) and (c) are correct.

QUESTION ANALYTICS +

Q. 10

FAQ | Solution Video | Have any Doubt ?

Let G_1 and G_2 be arbitrary context free languages and R be an arbitrary regular language. Consider the following problems:

I. Is $L(G_1) = L(G_2)$?
II. Is $L(G_2) \subseteq L(G_1)$?
III. Is $L(G_1) = R$?

Which of the above problems are undecidable?

A. I only

B. II only

C. I and II only

D. I, II and III — Your answer is **Correct**

Solution :
(d)
Checking CFL is equivalence, equality and subset problems for CFL are undecidable.

QUESTION ANALYTICS +